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Gregory R. Ganger, Dawson R. Engler, M. Frans Kaashoek, Héctor M. Briceño, Russell Hunt, Thomas Pinck
February 2002 **ACM Transactions on Computer Systems (TOCS)**, Volume 20 Issue 1

Full text available: [pdf\(500.67 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citing](#), [index terms](#)

Application-level networking is a promising software organization for improving performance and functi for important network services. The Xok/ExOS exokernel system includes application-level support for s network services, while at the same time allowing application writers to specialize networking services. paper describes how Xok/ExOS's kernel mechanisms and library operating system organization achieve flexibility, and retrospectively shares our experiences an ...

Keywords: Extensible systems, OS structure, fast servers, network services
- 2** [The transport layer: tutorial and survey](#)
Sami Iren, Paul D. Amer, Phillip T. Conrad
December 1999 **ACM Computing Surveys (CSUR)**, Volume 31 Issue 4

Full text available: [pdf\(261.78 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citing](#), [index terms](#)

Transport layer protocols provide for end-to-end communication between two or more hosts. This pape presents a tutorial on transport layer concepts and terminology, and a survey of transport layer service protocols. The transport layer protocol TCP is used as a reference point, and compared and contrasted nineteen other protocols designed over the past two decades. The service and protocol features of twel most important protocols are summarized in both text and tables.< ...

Keywords: TCP/IP networks, congestion control, flow control, transport protocol, transport service
- 3** [IO-Lite: a unified I/O buffering and caching system](#)
Vivek S. Pai, Peter Druschel, Willy Zwaenepoel
February 2000 **ACM Transactions on Computer Systems (TOCS)**, Volume 18 Issue 1

Full text available: [pdf\(196.15 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citing](#), [index terms](#)

This article presents the design, implementation, and evaluation of IO -Lite, a unified I/O buffering and system for general-purpose operating systems. IO-Lite unifies all buffering and caching in the system, l extent permitted by the hardware. In particular, it allows applications, the interprocess communication the file system, the file cache, and the network subsystem to safely and concurrently share a single phy copy of the data. Protection and ...

Keywords: I/O buffering, caching, networking, zero-copy

4 Client-server computing in mobile environments

Jin Jing, Abdelsalam Sumi Helal, Ahmed Elmagarmid

June 1999 **ACM Computing Surveys (CSUR)**, Volume 31 Issue 2Full text available:  pdf(233.31 KB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [re](#)

Recent advances in wireless data networking and portable information appliances have engendered a new paradigm of computing, called mobile computing, in which users carrying portable devices have access to information services regardless of their physical location or movement behavior. In the meantime, addressing information access in mobile environments has proliferated. In this survey, we provide a new framework and categorization of the various ways ...

Keywords: application adaptation, cache invalidation, caching, client/server, data dissemination, disco operation, mobile applications, mobile client/server, mobile computing, mobile data, mobility awareness system application

5 Garbage collecting the Internet: a survey of distributed garbage collection

Saleh E. Abdullahi, Graem A. Ringwood

September 1998 **ACM Computing Surveys (CSUR)**, Volume 30 Issue 3Full text available:  pdf(337.65 KB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [re](#)

Internet programming languages such as Java present new challenges to garbage-collection design. The spectrum of garbage-collection schema for linked structures distributed over a network are reviewed here. Distributed garbage collectors are classified first because they evolved from single-address-space collectors. A taxonomy is used as a framework to explore distribution issues: locality of action, communication overhead, and indeterministic communication latency.

Keywords: automatic storage reclamation, distributed, distributed file systems, distributed memories, distributed object-oriented management, memory management, network communication, object-oriented databases, reference counting

6 Exploiting task-level concurrency in a programmable network interface

Hyoung-youb Kim, Vijay S. Pai, Scott Rixner

June 2003 **ACM SIGPLAN Notices , Proceedings of the ninth ACM SIGPLAN symposium on Principles and practice of parallel programming**, Volume 38 Issue 10Full text available:  pdf(191.35 KB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Programmable network interfaces provide the potential to extend the functionality of network services to instruction processing overheads when compared to application-specific network interfaces. This paper attempts to offset those performance disadvantages by exploiting task-level concurrency in the workload to parallelize network interface firmware for a programmable controller with two processors. By carefully partitioning handler procedures that process various events related to ...

Keywords: ethernet, firmware, parallel programming, programmable network interface

7 Programming languages for mobile code

Tommy Thorn

September 1997 **ACM Computing Surveys (CSUR)**, Volume 29 Issue 3Full text available:  pdf(393.65 KB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [re](#)

Sun's announcement of the programming language Java more than anything popularized the notion of mobile code, that is, programs traveling on a heterogeneous network and automatically executing upon arrival at their destination. We describe several classes of mobile code and extract their common characteristics, which proves to be one of the major concerns. With these characteristics as reference points, we examine six representative languages proposed for mobile code. The conclusion ...

Keywords: Java, Limbo, Objective Caml, Obliq, Safe-Tcl, distribution, formal methods, mobile code, no programming, object orientation, portability, safety, security, telescript

8 Optimizing TCP forwarder performance

Oliver Spatscheck, Jørgen S. Hansen, John H. Hartman, Larry L. Peterson
April 2000 **IEEE/ACM Transactions on Networking (TON)**, Volume 8 Issue 2

Full text available:  pdf(119.23 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

Keywords: TCP, firewall, proxy, router

9 An integrated congestion management architecture for Internet hosts

Hari Balakrishnan, Hariharan S. Rahul, Srinivasan Seshan
August 1999 **ACM SIGCOMM Computer Communication Review , Proceedings of the conference on Applications, technologies, architectures, and protocols for computer communication**
29 Issue 4

Full text available:  pdf(1.61 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper presents a novel framework for managing network congestion from an end-to-end perspective. Work is motivated by trends in traffic patterns that threaten the long-term stability of the Internet. They include the use of multiple independent concurrent flows by Web applications and the increasing use of protocols and applications that do not adapt to congestion. We present an end-system architecture centered around a Congestion Manager (CM) that ensures proper congestion control.

10 Content management: Dynamic program insertion in high quality video over IP

Taehyun Kim, Jack Brassil
June 2003 **Proceedings of the 13th international workshop on Network and operating systems for digital audio and video**

Full text available:  pdf(269.10 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We introduce an overlay network architecture and signaling mechanism that permit program insertions into high quality video streams transmitted over IP networks. We describe the implementation of an application proxy that dynamically inserts pre-recorded video programs into NTSC D1 quality Motion-JPEG streams without visible artifacts. As computing power further enables the modification of video during transport, services such as personalized commercial advertisement insertion are possible.

Keywords: content delivery networks (CDNs), digital television (DTV), multimedia signaling, program system information protocol (PSIP), program cues, real-time transport protocol (RTP), video streaming

11 Balancing performance and flexibility with hardware support for network architectures

Ilija Hadžić, Jonathan M. Smith
November 2003 **ACM Transactions on Computer Systems (TOCS)**, Volume 21 Issue 4

Full text available:  pdf(719.03 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The goals of performance and flexibility are often at odds in the design of network systems. The tension is common enough to justify an architectural solution, rather than a set of context-specific solutions. The Programmable Protocol Processing Pipeline (P4) design uses programmable hardware to selectively accelerate protocol processing functions. A set of field-programmable gate arrays (FPGAs) and an associated library of network processing modules implemented in hardware are augmented with software.

Keywords: FPGA, P4, computer networking, flexibility, hardware, performance, programmable logic devices, programmable networks, protocol processing

A survey of rollback-recovery protocols in message-passing systems

E. N. (Mootaz) Elnozahy, Lorenzo Alvisi, Yi-Min Wang, David B. Johnson

September 2002 **ACM Computing Surveys (CSUR)**, Volume 34 Issue 3

Full text available:  pdf(549.68 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [re](#)

This survey covers rollback-recovery techniques that do not require special language constructs. In the of the survey we classify rollback-recovery protocols into *checkpoint-based* and *log-based*. *Checkpoint-* protocols rely solely on checkpointing for system state restoration. Checkpointing can be coordinated, uncoordinated, or communication-induced. *Log-based* protocols combine checkpointing with logging of nondeterministic events, encoded in tuples call ...

Keywords: message logging, rollback-recovery

13 Applications: YouServ: a web-hosting and content sharing tool for the masses

Roberto J. Bayardo Jr., Rakesh Agrawal, Daniel Gruhl, Amit Somani

May 2002 **Proceedings of the eleventh international conference on World Wide Web**

Full text available:  pdf(238.48 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

YouServ is a system that allows its users to pool existing desktop computing resources for *high availabi* hosting and file sharing. By exploiting standard web and internet protocols (e.g. HTTP and DNS), YouSe not require those who access YouServ-published content to install special purpose software. Because it minimal server-side resources and administration, YouServ can be provided at a very low cost. We des design, implementation, and a successful intrane ...

Keywords: decentralized systems, p2p, peer-to-peer networks, web hosting

14 Efficient user-space protocol implementations with QoS guarantees using real-time upcalls

R. Gopalakrishnan, Gurudatta M. Parulkar

August 1998 **IEEE/ACM Transactions on Networking (TON)**, Volume 6 Issue 4

Full text available:  pdf(205.42 KB)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

Keywords: multimedia communication, networks, operating system kernals, processor scheduling, pro real-time systems, transport protocols

15 Routing: ANODR: anonymous on demand routing with untraceable routes for mobile ad-hoc netw

Jiejun Kong, Xiaoyan Hong

June 2003 **Proceedings of the 4th ACM international symposium on Mobile ad hoc networking i computing**

Full text available:  pdf(236.79 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

In hostile environments, the enemy can launch traffic analysis against interceptable routing informatio embedded in routing messages and data packets. Allowing adversaries to trace network routes and infe motion pattern of nodes at the end of those routes may pose a serious threat to covert operations. We ANODR, an anonymous on-demand routing protocol for mobile ad hoc networks deployed in hostile environments. We address two closely related problems: For *route anonymity*, AN ...

Keywords: anonymity, broadcast, mobile ad-hoc network, on-demand routing, pseudonymity, trapdoc untraceability


16 The state of the art in locally distributed Web-server systems

Valeria Cardellini, Emiliano Casalicchio, Michele Colajanni, Philip S. Yu

June 2002 **ACM Computing Surveys (CSUR)**, Volume 34 Issue 2

Full text available:

Additional Information:

 pdf(1.41 MB)

[full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The overall increase in traffic on the World Wide Web is augmenting user-perceived response times for Web sites, especially in conjunction with special events. System platforms that do not replicate information content cannot provide the needed scalability to handle large traffic volumes and to match rapid and dramatic changes in the number of clients. The need to improve the performance of Web-based services has produced a variety of novel content delivery architectures. This article w ...

Keywords: Client/server, World Wide Web, cluster-based architectures, dispatching algorithms, distributed systems, load balancing, routing mechanisms

17 Extending Java for high-level Web service construction

Aske Simon Christensen, Anders Møller, Michael I. Schwartzbach

November 2003 **ACM Transactions on Programming Languages and Systems (TOPLAS)**, Volume 25 Is:

Full text available:  pdf(947.02 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We incorporate innovations from the <bigwig> project into the Java language to provide high-level features for Web service programming. The resulting language, Jwig, contains an advanced session model and a framework mechanism for dynamic construction of XML documents, in particular XHTML. To support program development we provide a suite of program analyses that at compile time verify for a given program that no runtime error can occur while building documents or receiving form input, and ...

Keywords: Interactive Web services, XML, data-flow analysis

18 Proxy-based acceleration of dynamically generated content on the world wide web: An approach and implementation

Anindya Datta, Kaushik Dutta, Helen Thomas, Debra Vandermeer, Krithi Ramamritham

June 2004 **ACM Transactions on Database Systems (TODS)**, Volume 29 Issue 2

Full text available:  pdf(927.23 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)


As Internet traffic continues to grow and websites become increasingly complex, performance and scalability are major issues for websites. Websites are increasingly relying on dynamic content generation applications to provide website visitors with dynamic, interactive, and personalized experiences. However, dynamic content generation comes at a cost---each request requires computation as well as communication across multiple components. To address these issues, various dynamic content caching approaches have been proposed. ...

Keywords: Edge caching, caching dynamically generated content, fragment caching, implementation, caching, world wide web

19 Prototyping, verification, and test: Implementation of BEE: a real-time large-scale hardware emulation engine

Chen Chang, Kimmo Kuusilinna, Brian Richards, Robert W. Brodersen

February 2003 **Proceedings of the 2003 ACM/SIGDA eleventh international symposium on Field programmable gate arrays**

Full text available:  pdf(3.65 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This paper describes the hardware implementation of a real-time, large-scale, multi-chip FPGA (Field Programmable Gate Array) based emulation engine with a capacity of 10 million ASIC (Application Specific Integrated Circuits) equivalent gates. Attainable system operation frequency can exceed 60 MHz, and the system throughput has been empirically verified to achieve 600 billion 16-bit additions per second. The engine is custom designed to maximize the performance and resource utilization for a ...

Keywords: FPGA, hardware emulation, rapid-prototyping

20 Hybrid dynamic data race detection

Robert O'Callahan, Jong-Deok Choi

June 2003 **ACM SIGPLAN Notices , Proceedings of the ninth ACM SIGPLAN symposium on Principles and practice of parallel programming**, Volume 38 Issue 10

Full text available:  pdf(158.47 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We present a new method for dynamically detecting potential data races in multithreaded programs. Our method improves on the state of the art in accuracy, in usability, and in overhead. We improve accuracy by combining two previously known race detection techniques -- *lockset-based detection* and *happens-before based detection* -- to obtain fewer false positives than lockset-based detection alone. We enhance usability by reporting more information about detected races than any previous dynamic ...

Keywords: Java, dynamic race detection, happens-before, lockset hybrid

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[Thanasis Hadzilacos](#) Computer Technology Institute, University of Patras, Greece

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